Temperature, Moisture, and Herbicide Effects on Germination of Dyer's Woad Seeds

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Dyer's woad (*Isatis tinctoria*) (Fig. 1) is a problematic, invasive weed in the intermountain west, including far northern California. Although it can be controlled by properly-timed herbicide applications prior to seed set (Fig. 2), further spread along roadsides and in isolated areas is occurring (Fig. 3). Research during 2012-14 has shown that some seeds become germinable at early stages of seed set, and the proportion increases over the period of maturation. Preliminary herbicide trials with glyphosate or 2,4-D at late bloom or during seed maturation showed that such delayed applications may not prevent viable seed production and subsequent germination. Additional studies were initiated to examine the feasibility of integrated management using solar tents (Fig. 4) to eliminate viable seeds on senescent skeleton plants in small stands of woad. Moistened seeds, enclosed within silicles, were susceptible to effects of high temperature. Preliminary data showed seed germination to be completely inhibited by 20 min exposure to 70 C; 75 min to 60 C; and 28 hr to 50 C. The silicle covering provided protection to seeds against heat exposure, especially at the lower temperatures tested. Field experiments were conducted during summer months in Scott Valley, Siskiyou County, California to test effects of seed incubation in solar tents (Fig. 5) on germination. The trials indicated that germination of seed lots completely immersed in water could be greatly reduced in solar tents.

Fig. 1. Dyer's woad (*Isatis tinctoria* L.). From Hurry (1930).

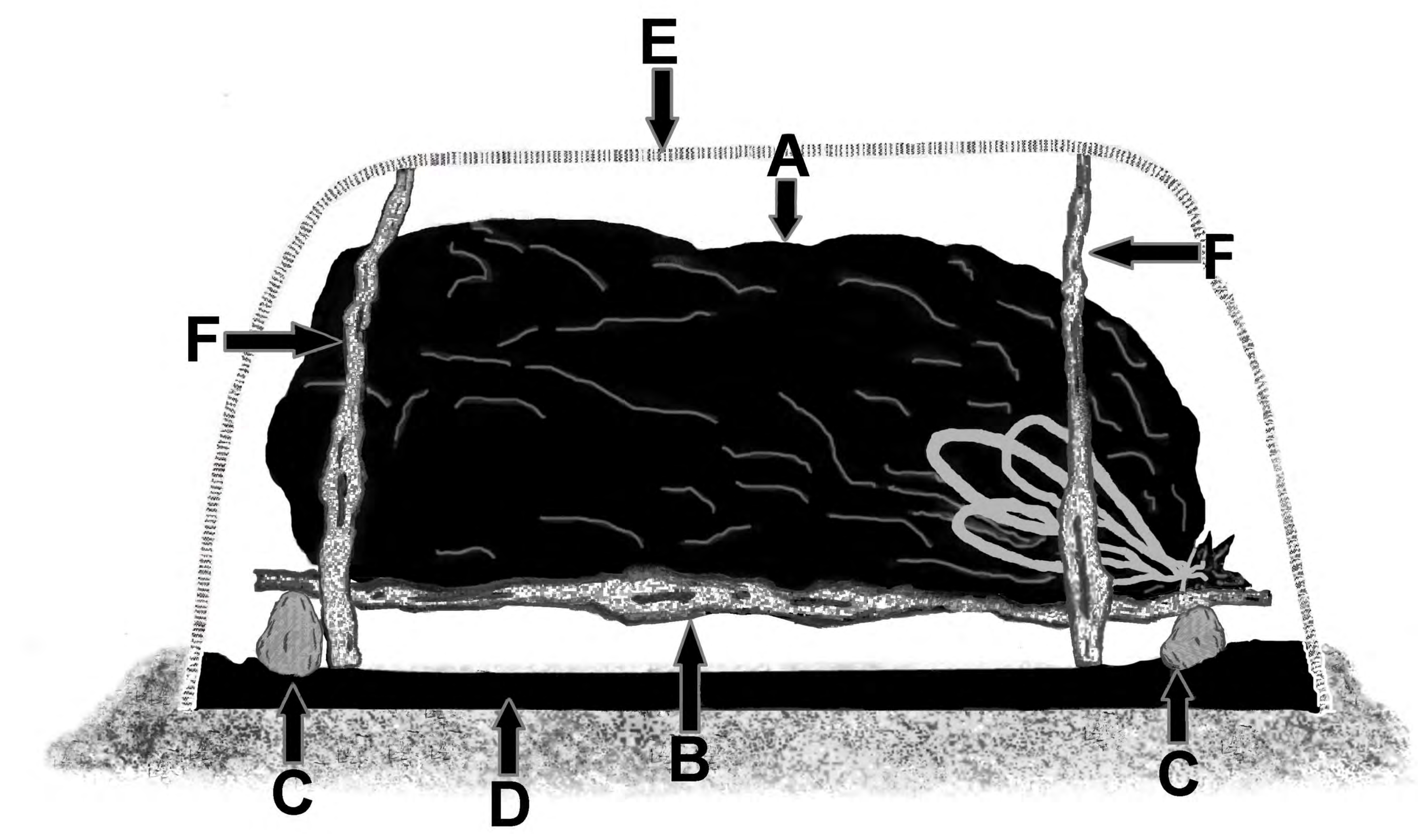

Fig. 4. Diagram of experimental solar tent construction: (a) closed black plastic trash bag, containing targeted seeds in plastic, 5-gallon buckets partially filled with water; (b) interior framework of woody plant shoots sitting on (c) rocks, to elevate bags above soil surface and facilitate 360^o heating; (d) sheet of black plastic film on soil surface to assist with heat accumulation & preclude seed escape; (e) clear plastic sheet, supported by (f) hoops of woody plant shoots to form a tent over the treatment bag; (g) exterior rocks, soil, and/or logs sealing edges of tent canopy to minimize heat loss & preclude seed escape. Adapted from Stapleton (2012)

Fig. 2. Dyer's woad plants flowering in springtime. Scott Valley, California

Fig. 3. Seed-bearing Dyer's woad plants senescing in summer. Scott Valley, California

Fig. 5. Representative construction of experimental solar tents in the field.

Further Reading

Hurry, J. B. 1930. *The Woad Plant and its Dye*. Oxford University Press, London. 328 p.

Orloff, S. B., 2008. Dyer's woad (Marlahan mustard): control it now before it sets seed. Website *http://cesiskiyou.ucanr.edu/newsletters/Spring_200839564.pdf*

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Stapleton, J.J., and Orloff, S.B. 2015. Dyer's woad: an invasive weed pest threatening the intermountain region of California. CAPCA *Adviser* magazine, Feb. 2015, pp. 36-38. Website *http://capca.com/assets/magazine/February2015/index.html*